WIRELESS BASED HOME SECURITY WITH AUTOMATION SYSTEM

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"I hereby acknowledge that the scope and quality of this thesis is qualified for the award of the Bachelor Degree of Electrical Engineering (Electronics)"

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ABSTRACT

The aim of the project is to design a wireless based home security with automation system. The system uses wireless technology to revolutionize the standards of living which could give assurance for user to protect their homes from burglars, thieves and criminals. This project is so versatile and is equipped with various sensors such as passive infrared sensor, magnetic switch sensor and vibration sensor to detect different forms of intrusion. A microcontroller is used to control the system operation while a remote gadget is used to arm and disarm the system. To ensure only the authorized user can operate the system, the gadget is equipped with a password. Various indication outputs such as BUZZER, LED and LCD are used to display the alarm status. In addition, the sound indicators like siren are also included in the design to inform intrusion. Due to the consideration of user-friendliness, portability as well as wider-area coverage, all the sensors and remote gadget are implemented using zigbee transceiver. A backup battery module is also introduced in the design to ensure the system keep functioning even during power failure.

ABSTRAK

Projek ini bertujuan untuk menghasilkan sebuah sistem keselamatan tanpa wayar dengan kelengkapan sistem automasi. Sistem ini menggunakan teknologi tanpa wayar yang mengesyorkan satu revolusi kehidupan yang menawarkan satu jaminan keselamatan bagi pengguna untuk melindungi rumah mereka dari perompak, pencuri dan penjahat. Projek serba boleh ini dilengkapi dengan pelbagai jenis pengesan seperti pengesan pasif infra merah, pengesan suis magnet dan pengesan getaran untuk mengesan sebarang bentuk pencerobohan. Pengawal mikro digunakan untuk mengawal keseluruhan sistem operasi sementara alat kawalan jauh digunakan untuk mengaktifkan sistem. Bagi memastikan hanya pengguna yang sah boleh mengawal sistem, alat kawalan jauh ini dilengkapi dengan kata laluan. Beberapa output seperti BUZZER, LED dan LCD digunakan untuk mempamerkan status semasa dan tanda bunyi seperti siren digunakan untuk memberitahu pencerobohan. Semua pengesan dan alat kawalan jauh di hubungkan tanpa wayar dengan menggunakan teknologi zigbee supaya sistem keselamatan ini menjadi lebih mudah digunakan oleh pengguna, mudah alih dan dapat melindungi kawasan yang lebih luas. Begitu juga sistem ini dilengkapi dengan bateri sokongan untuk memastikan sistem berfungsi walaupun semasa kegagalan sistem bekalan kuasa.

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LIST OF ABBREVIATIONS

EEPROM	Electrical Erasable Programmable ROM
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
IR	Infrared
LCD	Liquid Crystal Display
LED	Light Emitted Diode
MAC	Medium Access Layer
MCU	Microcontroller Unit
MOSFET	Metal–Oxide–Semiconductor Field-Effect Transistor
PC	Personal computer
PHY	Physical Layer
PIR	Passive Infrared
PMP	Property Management Person
RF	Radio Frequency
SCI	Asynchronous Serial Communication Interface
SMS	Short Message Service
SPI	Synchronous Serial Peripheral Interface
WYSAS	Wireless Based Home Security with Automation System

LIST OF SYMBOLS

Gnd	0 Volt Ground
Rx	Receive
Tx	Transmit
V	Volts
VDD	+5 Volts Direct Current

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays, the most common threat to home resident is burglary. Millions of Ringgit are lost in each day. By definition, the crime of burglary is breaking and entering a residence for the intention of committing a crime or while lawfully within, commit a crime and to thereafter break out, usually crime that occurs when homeowner are not at home. A crime reduction adviser is suggesting that homeowners should spend money investing on security measures, which could to guard the place from intrusion [1].

Home security system is necessary in order to enhance the occupants, convenience and safe environment from any in invasion [2]. All the home security systems are designed to achieve the same purpose – to thwart a break-in attempt. The most basic of all of the types of the home security system is the simple electric circuit built into an entry way alarm. Some home security systems are wired to all potential entries into the home, including doors and windows. In a more exhaustive way, a basic home security system is often system consists of intrusion detectors, a control panel, and a triggered-on siren. The intrusion detectors or more commonly

known as intrusion sensors, include magnetic switch, passive infrared sensor, and vibration sensor.

However, one very familiar problem related to a home security system is the tendency of alarm. If the occupants live in an area with high crime rates or in a rural area with few or no neighbours and travel frequently, the homeowner should consider a more complete and flexible home alarm security. Thus, the home security should also consider the zone of coverage of the system. The connection mode, home security network can be classified into two kinds whether wireless network and non-wireless. However, for the latter technology, the coverage is encapsulated to several meters. In addition, the drilling and wall hacking during alarm installation are definitely a frustrating experience. To make it worst the alarm has been installed, the limitation of the re-localize some of its components is relatively uneasy. The cost of installing a whole security system could achieve around a thousand of Ringgit Malaysia [3] [4].

The aim of the project is to implement the wireless based home security featuring automation system. The system is equipped with several sensors nodes that may include such as passive infrared sensor, magnetic switch sensor, and vibration sensor to detect different forms of intrusion. PIC18F4550 microcontroller is embedded in the master node to control the system operation. In addition, various indication outputs such as LED and Liquid Crystal Display (LCD) are used to display the alarm status, and sound indicators like buzzer, and siren are used to inform intrusion that are applied in the design. Due to the consideration of user-friendliness, portability as well as wider-area coverage, passive infrared sensor is implemented using zigbee wireless technology. To make the system versatile and handy, a handheld remote device is designed for the user to arm and disarm the system. The remote also can be used to active any devices such as lamp, fan or gate and trigger an alarm if suspicious visitors are existed or when the user feel threat or insecure. A backup battery module is used allow the system function during power failure.

1.2 Project Objective

The objective of this project is to design a zigbee based home security featuring automation system. The system uses this new wireless technology to revolutionize the standards of living which could provide assurance for user to protect their homes from burglars, thieves and criminals. The system consists of various sensors such as passive infrared sensor, smoke detector, magnetic switch sensor and motion detector to detect the possibly of intrusion. This system provides ideal solution to the problems faced by home owners in daily life. . In addition, the Zigbee-based system offers home automation feature to allow user to control home devices remotely.

1.2 Project Scope

There are a few scopes and guidelines are listed to ensure the project can be accomplished. They include:

- The system should be portable and easy to be operated
- The system should be reliable and efficient.
- The system offers various types of sensors to suit the location or environment.
- To build a compact remote gadget to control several home devices

1.3 Thesis Outline

This thesis is divided into six chapters. The contents of each chapter are summarized as below.

Chapter 1 an introduction where it discusses the current technology of wireless security system. This chapter consists the overview of the objective and scope of the project. It also summarizes the content of the thesis.

Chapter 2 elaborates the recent research on the technology. It emphasizes the role of zigbee in various applications.

Chapter 3 explains the system architecture and operation of the wireless based home security. It describes briefly the hardware components used in this project.

Chapter 4 discusses the details of hardware design of each module. The connections of hardware are shown in circuit schematic diagram.

Chapter 5 discusses the development of the software. Each module is explained in detail to provide better perspective of the system.

Chapter 6 shows and emphasizes the testing and result of the project. Each module is tested independently before they are combined into a system. Testing and result that obtained from this project will be discussed in great details.

Chapter 7 provides the conclusion of the project progress. It also discusses the future recommendation to improve the system performance.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will elaborate the recent research on the new technology. It emphasizes the role of zigbee in many applications. Research and findings have been conducted in order to design and develop Wireless Based Home Security With Automation System (WYSAS) that will suit the aims and objective in this project. Several of the existing researches conducted the same field that will give inspiring ideas of designing and developing WYSAS.

2.2 Zigbee Technology and Previous Research

Currently, the implementation of wireless technologies increased with the rapid expansion. There are various wireless technologies available, for example Bluetooth, Infrared (IR), Radio Frequency (RF) and other which have been explored by the most people in modern society. However, currently many of the wireless sensor network systems are now using ZigBee to employ the designs. ZigBee is created to satisfy the market's need for a cost-effective, standards-based wireless networks that support low data rates, low power consumption, security, robustness

and reliability [6]. The major applications that offered by ZigBee focus on sensor and automatic control, such as military application, industrial control, smart buildings and environment monitoring.

The ZigBee protocol uses the IEEE 802.15.4-2003 specification as its Medium Access Layer (MAC) and Physical Layer (PHY). The ZigBee protocol wireless network support three types of configurations such as star topology, tree topology and mesh topology. In a star topology, the network is controlled by one single device called the ZigBee coordinator. The ZigBee coordinator is responsible for initiating and maintaining the devices on the network, and all other devices, known as end devices, directly communicate with the ZigBee coordinator. In mesh and tree topologies, the ZigBee coordinator is responsible for starting the network and for choosing certain key network parameters but the network may be extended through the use of ZigBee routers. In tree networks, routers move data and control messages through the network using a hierarchical routing strategy. Mesh networks shall allow full peer-to-peer communication [7, 16]. Figure 2.1 shows the topology of zigbee network.

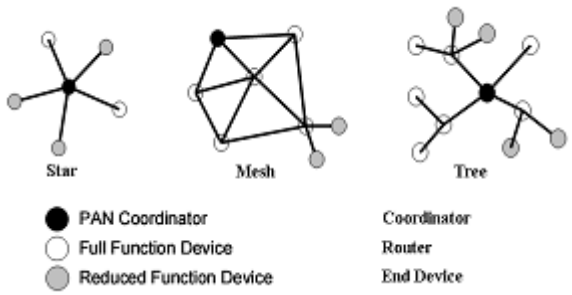

Figure 2.1: Topology of zigbee network

ZigBee technology and the Home Automation profile provide interoperability from different vendors that allow a greater range of control and integration of different devices in the home. For example, a home security system, along with its basic monitoring functions can be expanded to provide status and control of home lighting when entering and exiting a home.

According to [8] [16], ZigBee technology offers a multi-hop communication capability for data transfer. Multi-hop communication will provide unlimited range of communication for the system as long as there are intermediate nodes that will pass the data from one node to another until it reaches the destination. In [8], it introduces the conceptual understanding and strategy of ZigBee IEEE 802.15.4 standard to be deployed in smart home environment. It offers two importance features of a smart home; home security and home automation. In home security, the hardware implementation consists of the development of the main controller, sensor nodes and the smart home sensor network. The main controller is equipped with a GSM modem that is used to send and receive SMSes. If any one of the sensor node is triggered, it will send an alert signal to the main controller through the intermediate nodes using multi-hop communication. When the main controller receives the alert signal, it will then send the alert signal to the user by using SMS via the GSM Modem which is attached to the main controller. Figure 2.2 shows the operation of this built home security system.

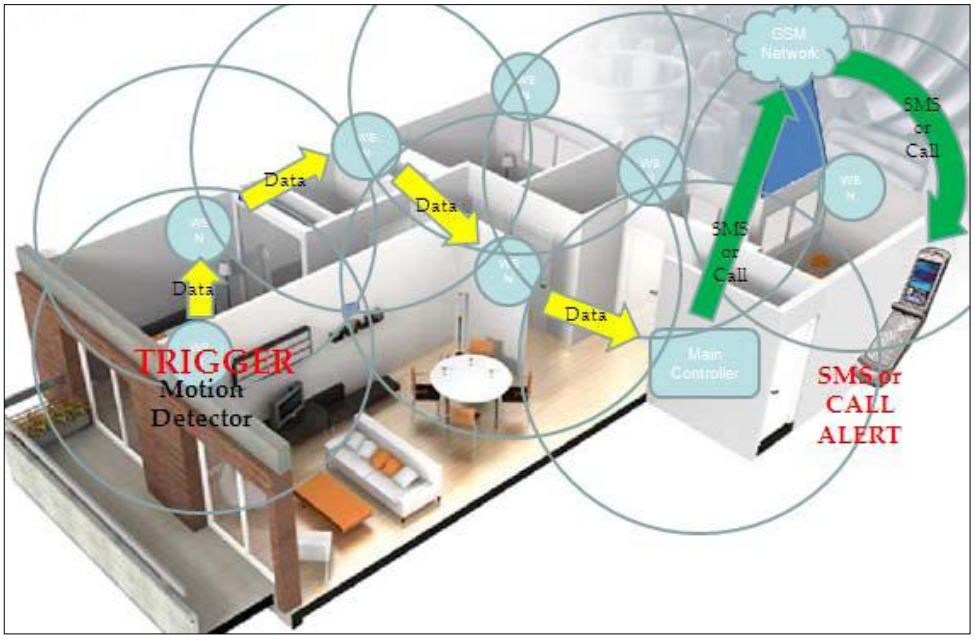

Figure 2.2: Security System